

To what extent do specific subpopulations practice unsafe food safety behaviors?

Conclusion

Moderate available evidence, which focused on pregnant women, college students and older adults, shows that these populations commonly practice unsafe food handling and consumption behaviors.

Grade: Moderate

Overall strength of the available supporting evidence: Strong; Moderate; Limited; Expert Opinion Only; Grade not assignable For additional information regarding how to interpret grades, [click here](#).

Evidence Summary Overview

A total of nine studies (eight cross-sectional studies and one non-randomized trial) were reviewed regarding the extent to which specific sub-populations (pregnant women, college students and older adults) practice unsafe food safety behaviors. All nine studies received neutral quality ratings.

Pregnant women:

Trepka et al, 2007, studying a sample consisting predominantly of African- American Women, Infants and Children (WIC) participants, found that pregnant women reported practicing risky food handling and consumption behaviors that could put them at greater risk for acquiring listeriosis. For example, pregnant women reported eating hot dogs or deli meats without first reheating and reported eating soft cheeses and blue-veined cheeses. Using a cooking thermometer, refrigerating foods within two hours, and thawing frozen foods safely were the least frequently reported recommended food safety behaviors. Primiparous women had lower food safety scores than their multiparous counterparts. Kwon et al, (2008) applied a food safety survey in 87 WIC offices in 31 states. The need for a meat thermometer to check doneness while cooking ground beef patties was acknowledged by 23.7% of respondents, but only 7.7% reported actually using it when cooking ground beef patties. Hispanic women were the least likely to have ever used a meat thermometer (25.4%), followed by non-Hispanic Black women (36.2%) and non-Hispanic white women (46.1%). More than 40% of respondents did not use adequate methods to thaw frozen foods, with the likelihood of this happening being much higher among Hispanic and non-Hispanic Black individuals than among their White counterparts. The overall food safety knowledge score was significantly higher among those with higher levels of education and white (vs. Hispanic) women. However, the food safety behavior score was not significantly (NS) different when comparing white women with their Hispanic counterparts. African-American women had the lowest food safety behavior score.

College students:

Four studies agree that US college students do not engage in many recommended safe food-handling practices (Abbot et al, 2009; Byrd-Bredbenner et al, 2007; Byrd-Bredbenner et al, 2008; Yarrow et al, 2009). Participants in the study by Abbot et al, (2009) self-reported engaging in less than half of the recommended safe food-handling practices evaluated (i.e., cross-contamination, hygiene, cooking temperatures, food storage, risky food consumption). This was confirmed through direct observation of their food preparation behaviors in a laboratory kitchen. For example, only half of them practiced adequate hand and kitchen sanitation; one-third did not follow adequate procedures to prevent cross-contamination between raw chicken and ready-to-eat produce; and more than 70% did not follow recommended procedures for safe chicken cooking. Byrd-Bredbenner et al, (2007), audited the home kitchens of the same college students studied by Abbot et al, (2009), and found that their scores were lower than 60% on the kitchen appliance cleanliness (i.e., microwave oven, can opener, dishwasher) and cold food storage scales and that only 7% of kitchens had a food thermometer. Mean refrigerator temperature was 6.1 °C (range: 0-16 °C) which is higher than recommended (i.e., 4.4 °C/40°F or below). Byrd-Bredbenner et al, (2008) found in an online survey among college students across the US that they reported consuming some “risky foods” including homemade cookie dough containing raw eggs (53%); fried eggs with runny or soft yolks (33%); sushi (29%); raw sprouts (29%), raw oysters, clams, or mussels (11%); and hamburgers cooked rare (7%). Male students ate significantly more “risky foods” than women ($P<0.0001$). While consumption of raw or undercooked animal source foods may be culturally or socially acceptable or desirable, consumers should be aware of the health risks associated with the consumption of these foods. Yarrow et al, (2009) found that non-health majors whose food safety beliefs and knowledge improved after exposure to a food safety educational intervention, showed no improvements in the practice of risky behaviors, including not using thermometers and eating “risky foods,” as a result.

Older adults:

Three studies (Almanza et al, 2007; Kosa et al, 2007; Roseman, 2007) agree that older adults report partaking in risky food-handling behaviors. A study of Elderly Nutrition Program clients (Roseman, 2007) found that 22% reported not throwing away casseroles or other food dishes that had been left on the counter for two or more hours (41% of men vs. 18% of women, $P=0.004$). Fifty percent of the oldest group (≥ 91 years) and 36% of the ages 60 to 70 years group, kept all or part of their

unconsumed meal on the counter instead of the refrigerator, and 16 % were somewhat or not likely to wash hands before eating their meals. Whereas 93% of White respondents indicated that they would throw away a meal that was left on counter overnight, this was true for only 77% of their non-White counterparts. The risk of practicing this behavior was also lower among the more educated and those in younger age brackets. Almanza et al, (2007) report from a multi-state study that of the 35% of seniors who kept leftovers from a home-delivered meal program, only 15% ate the non-refrigerated leftovers within two hours. Also, 38% of participants who were delivered hot food and did not consume it right away left it on a counter or table. Kosa et al, (2007) found that only 16% of older adults participating in a nationally representative web-based survey had a refrigerator thermometer at home. Older adults who were not married and who lived alone were less likely to have refrigerator thermometers or have their refrigerators at a recommended temperature ($P<0.05$).

Evidence Summary Paragraphs

Abbot et al, 2009 (neutral quality) cross-sectional study in which 153 young adults, from an university in New Jersey, prepared a meal under observation in a controlled laboratory setting, permitted researchers to observe their home kitchen, and completed an online survey assessing their food safety knowledge, behavior, and psychosocial measures. Mean best practices scale scores were poor, with subjects reporting they engage in less than half of the recommended safe food-handling practices evaluated. Food preparation observation mean scores were sub-optimal, with highest mean compliance score for the “separate” scale (67%) and lowest for the Cook scale (29%), such that two-thirds of subjects kept raw animal protein separated from ready-to-eat food; whereas 97% did not use a thermometer to determine that that protein was cooked to safe temperature. On the positive side, three home kitchen observation mean scale scores (for kitchen facilities cleanliness, dry food storage and poisons storage) exceeded 81% compliance. Few significant differences in mean scores for best practices, risky food consumption, beliefs, self-efficacy, knowledge or observations were noted among demographic groups. Authors conclude that while consumers may possess some food safety knowledge, this does not necessarily translate into safe food handling practices.

Almanza et al, 2007 (neutral quality) cross-sectional study, assessed the typical handling practices of home-delivered meals used by 833 clients (258 (31%) males; 575 (69%) females), mean age of 79.5 years, from 50 home-delivered meal preparation sites in four states (Indiana, Texas, Washington, New Hampshire). Subjects were provided a voluntary survey and requested by home-delivery drivers to complete a self-administered questionnaire, that was collected by the driver the following day; a driver questionnaire was also used to track the departure time from the meal preparation site and arrival time of each home-delivered meal at the subject's home, and the time the meal was held in the home before consumption. Significant differences among groups on the basis of a derived food safety knowledge score were observed in terms of whether or not they ate their meal immediately ($P\leq0.05$); 63% reported that they ate their meals as soon as they were delivered; of those who did not eat their meals immediately after delivery, 82% stored the cold food in the refrigerator and 58% stored the hot food in the freezer, but 37.7% did not keep hot food safe after meals were delivered and instead left the food on a counter or table; 57.1% who ate meals immediately did not re-heat the foods before eating them even though those meals were not perceived as hot; 35% reported that they had leftovers and only 15% ate the leftovers within two hours, 41% reported that they ate leftovers between four hours and four days after delivery. Study showed that the total time period from preparation at the sites to the time of consumption depends primarily on the time of consumption after delivery, rather than the time required for delivery. Authors note that continued efforts from food service providers on holding, handling, and packaging of home-delivered meals are needed to help protect this at-risk consumer group along with new efforts to educate clients and promote proper handling once meals are delivered.

Byrd-Bredbenner et al, 2007 (neutral quality) cross-sectional survey, audited the home kitchens of 154 young adults at a northeastern university to identify food safety problems. Home kitchen audits assessed kitchen cleanliness, appliance cleanliness, cleaning supplies availability, temperatures (thermometer access and refrigerator/freezer temperatures), cold food storage, dry food storage and poisons storage. Participants scored 70% or higher on poisons storage, dry food storage, kitchen cleanliness, and cleaning supplies availability, with females scoring higher than males on kitchen cleanliness ($P=0.0183$) and cleaning supplies availability ($P=0.0305$). Participants scores lower than 60% on the appliance cleanliness and cold food storage scales. Performance was lowest on the temperatures scale; only 7% of kitchens had a food thermometer.

Byrd-Bredbenner et al, 2008 (neutral quality) cross-sectional survey assessed risky eating behaviors among 4,343 (female: 65%, male:35%) young adults enrolled in 21 colleges and universities located in 17 US states (mean age 19.92 ± 1.67 years). Students across the US, enrolled in introductory courses, were invited to complete an on-line food safety survey January through October, 2005. A calculated mean risky eating score of 5.1 ± 3.6 indicated college students consume some risky foods (53% consumed raw homemade cookie dough; 33% consumed fried eggs with runny or soft yolks; 29% consumed sushi; 29% raw sprouts; 11% raw oysters, clams, or mussels; and 7% consumed hamburgers cooked rare). Men ate significantly more risky foods than women ($P<0.0001$), white participants engaged in significantly more risky eating behaviors than nonwhite participants ($P<0.001$). Students had strong feelings of food safety self-efficacy (4.1 ± 0.6), were between the contemplation and preparation stage-of-change (2.7 ± 1.2), believed food poisoning was somewhat of a threat (3.1 ± 0.8) and had modest food safety knowledge.

Kosa et al, 2007 (neutral-quality) cross-sectional study, surveyed a nationally representative sample of 2,060 adults in the US (249 pregnant women, 946 older adults and 865 from the remaining population) to collect data on refrigerator thermometer ownership, home refrigerator temperatures, and the frequency of cleaning for home refrigerators. The demographic characteristics of consumers following government-recommended refrigerator practices were also assessed, in terms of gender, age, educational background, marital status, household size, race or ethnicity, household income, metropolitan status, and whether or not a member of the household had been diagnosed with diabetes, kidney disease, or another condition that weakens the immune system. About half (47.4%) of all respondents had cleaned their refrigerators at least one month prior to the survey. Only 10.7% of all respondents


had a thermometer in their refrigerator prior to the survey. After receiving the refrigerator thermometer as part of the survey, 72% of all respondents reported that their refrigerators were at the recommended temperature.


Kwon et al, 2008 (neutral quality) cross-sectional study in which 1,598 female participants in the Special Supplemental Nutrition Program for WIC from 87 WIC agencies in 31 states in US responded to a nationwide survey to assess food safety knowledge and behaviors of WIC Program participants. Knowledge and behavior scores differed significantly among participants of different education levels and racial or ethnic groups ($P < 0.001$) with those with some high school or less education having significantly lower knowledge and behavior scores than respondents with high school or beyond high school; white respondents had significantly higher knowledge scores than did Hispanic respondents and black respondents had significantly lower behavior scores than did members of the other three racial or ethnic groups ($P < 0.001$). Regarding associations between knowledge and behaviors and demographic characteristics, respondents > 25 years old had higher mean food safety knowledge and behavior scores than for those 18-25 years old; Hispanic or black respondents and those who did not graduate from high school were less likely to have used a food thermometer; white respondents with a high school education thawed frozen meat, poultry and fish items more safely than Hispanic and black respondents, and those without a high school diploma; and more black respondents consumed undercooked ground beef patties than did whites or Hispanics. Results reinforced previous research indicating discrepancies between knowledge and reported food handling behaviors existed in cleaning and sanitizing cutting boards, handling hot food leftovers, using food thermometers and checking doneness of ground beef patties.



Roseman, 2007 (neutral quality) cross-sectional study, surveyed 220 elderly adults who participated in either a congregate or home-delivered meal program in Kentucky. The survey asked questions related to food safety perceptions, food safety behavior and emergency food preparedness. Twenty-seven percent thought food borne illness was not a common problem and 21% thought the problem was most likely to occur at a place other than home. 21 percent reported leaving casseroles or similar food on the counter for two or more hours before throwing it away. A total of 21.7% reported not throwing away casseroles or other food dishes that had been left on the counter for two or more hours (41.2% of men vs. 18.0% of women, $P = 0.004$); 50.0% of the oldest group (≥ 91 years) and 36.1% of the ages 60 to 70 years group, kept all or part of their unconsumed meal on the counter instead of the refrigerator, and 16.4% were somewhat or not likely to wash hands before eating their meals. Whereas 92.7% of White respondents indicated that they would throw away a meal that was left on the counter overnight, this was true for only 77.4% of their non-White counterparts. The risk of practicing this behavior was also lower among the less educated and those in younger age brackets. Results indicate that some elderly nutrition program clients have precarious food safety perceptions and partake in risky food-handling behaviors.



Trepka et al, 2007 (neutral quality) cross-sectional study, assessed baseline food safety practices among 299 clients served by an inner city MiamiWIC program. A 23-item self-administered questionnaire addressed food safety practices related to cleanliness, separation or avoidance of cross-contamination, proper cooking and chilling methods and avoidance of unsafe foods during pregnancy. In general, participants reported “almost always” or “always” following good practices in the clean and separate constructs, but the frequency of “always” or “almost always” washing hands after changing diapers was significantly lower (83.6%) than the frequency of “always” or “almost always” washing hands after using the toilet (93.0%) ($P < 0.001$). 12.6% of participants reported not properly cleaning cutting boards after contact with raw meat. Only one-fourth of the participants reported using a cooking thermometer “almost always” or “always” for cooking whole chicken or turkeys (23.4%) or other large pieces of meat (22.3%), and only 24.4% reported owning a thermometer. A total of 24.7% reported usually eating undercooked eggs and 32.2% of the participants reported usually leaving food out for more than two hours. Only 17.3% reported refrigerating large amounts of leftovers in shallow containers and 10.8% reported leaving formula or bottled breast milk outside the refrigerator for more than two hours “most of the time,” “almost always,” or “always,” and 61.8% reported thawing foods on the countertop or in the sink in standing water. A total of 51.6% of pregnant women reported eating hot dogs or deli meats without first reheating sometimes or more frequently since becoming pregnant and 35.5% reported eating soft cheeses and blue-veined cheeses sometimes or more frequently since becoming pregnant. Both of these practices carry a risk of acquiring listeriosis.


Yarrow et al, 2009 (neutral quality) nonrandomized trial, evaluated the food safety attitudes, beliefs, knowledge and self-reported practices of 59 Kansas State University college students (38 females and 21 males), ages 21 to 49 years, who were either health majors ($N = 38$) or non-health majors ($N = 21$) and whether those variables were positively influenced by a food safety educational intervention. Subjects completed a food safety questionnaire (FSQ) prior to educational intervention involving three interactive modules, and then the FSQ was administered after exposure to the intervention and five weeks later to determine changes in food safety attitudes, beliefs, knowledge and self-reported practices. Self-reported safe food practices became more frequent over time in subjects, with scores increasing from 19 to 21 of 27 possible points ($P \leq 0.001$); students became less likely to prepare food for others if they had diarrhea ($P \leq 0.001$), and more likely to use food thermometers ($P \leq 0.01$); the reported changes can be attributed to health majors' improvement in not preparing food for others if they had diarrhea ($P \leq 0.002$), thermometer use ($P \leq 0.006$), and not leaving cooked items out for use later in the day ($P = 0.046$) such as a buffet or party. Non-health majors did not improve in self-reported practices whereas health majors scored higher than non-health majors for all indices in each time period except for high risk food intake ($P \leq 0.001$). As a total group and sub-groups, no significant changes occurred among the students' self-reported practices for food sanitation, hygiene, storage, thawing or high-risk food intake. Even after food safety beliefs and knowledge improved with exposure to the intervention, non-health majors were not more inclined to change their risky behaviors (such as using thermometers and eating fewer risky foods).


Author, Year, Study Design, Class, Rating	Population/Sample Description and Location	Study Design/I & D Variables/Intervention	Results/Behavioral Outcomes/Significance	Limitations
<p>Abbot et al, 2009</p> <p>Study Design: Cross-sectional study.</p> <p>Class: D</p> <p>Rating: </p>	<p>N=153 young adults (56% female).</p> <p>Mean age: 20.74±1.30 SD (range 18-26) years.</p> <p>67% white.</p> <p>97% never married.</p> <p>85% juniors or seniors in college.</p> <p>Rutgers University, New Brunswick, NJ.</p>	<p>Design</p> <p>Each subject prepared a meal under observation in a controlled laboratory setting, permitted researchers to observe their home kitchen, and completed online survey assessing their food safety knowledge, behavior and psychosocial measures.</p> <p>Dependent Variables</p> <p>Scores of the five food preparation observation scales: Clean; Separate; Cook; Chill; Cross-contamination.</p> <p>Seven home Kitchen observation scales: Kitchen facilities cleanliness; Appliance cleanliness; Access to cleaning supplies; Thermometer access/temperature control; Cold food storage practices; Dry food storage practices; Poisons storage practices.</p> <p>Independent Variables</p> <p>Best practices scores.</p> <p>Risky food consumption score.</p> <p>Beliefs scale scores.</p> <p>Self-efficacy score.</p> <p>Predominant locus of control.</p> <p>Stage of change.</p> <p>Knowledge scale scores.</p> <p>Demographic characteristics (gender; race; age; year in college).</p> <p>Whether they had held a job as a food server or preparer.</p> <p>Prior food safety instruction (e.g., completed at least one nutrition, food science or microbiology college course</p>	<p>Mean best practices scale scores were poor, with subjects reporting they engage in</p> <p>Majority of subjects reported they or household member had food poisoning (86%) with no Δ in their eating behavior in response to publicized food poisoning outbreak.</p> <p>Few significant differences in mean scores for best practices, risky food consumption, beliefs, self-efficacy, knowledge or observations noted among demographic groups.</p> <p>Knowledge scale of groups at greatest risk of foodborne disease and cross-contamination prevention self-report behavior scale tended to be significant predictors of actual food preparation behaviors.</p> <p>Food preparation observation mean scores were suboptimal, with highest mean compliance score for the "separate" scale (67%) and lowest for the Cook scale (29%), such that two-thirds of subjects kept raw animal protein separated from ready-to-eat food; whereas 97% did not use a thermometer to determine that protein was cooked to safe temperature.</p> <p>On positive side, three home kitchen observation mean scale scores (for kitchen facilities</p>	<p>Per authors:</p> <p>Low P-values for the significant predictor variables in the regression models present as a limitation of this analysis.</p> <p>Similar evaluations should be done with larger sample sizes that can further define stronger predictor variables and better descriptions of the disconnect between what young adults report/know about food safety and what they are observed practicing.</p>


		vs. those who had not).	<p>cleanliness, dry food storage and poisons storage) exceeded 81% compliance.</p> <p>Subjects had a predominantly internal locus of control for safe food handling (65%) and ↑ levels of food safety self-efficacy, but observed food handling practices did not indicate that these health-promoting cognitions are translated into actually performing safe food-handling practices.</p>	
<p>Almanza BA, Namkung Y et al, 2007</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>N=833 clients [258 (31%) males; 575 (69%) females].</p> <p>Mean age: 79.5 years (10.3% <64; 17.5%, 65-74; 36.6%, 75-84; 85.6%, 85+ years).</p> <p>Regarding clients meal consumption behavior, N=851.</p>	<p>Design</p> <p>Once permission was given by home-delivered meal site directors, subjects provided voluntary survey and requested by home-delivery drivers to complete a self-administered questionnaire that was collected by driver the next day.</p> <p>A driver questionnaire was used to track departure time from meal preparation site and arrival time of home-delivered meal, and time meal was held in home before consumption.</p> <p>Subjects were classified, for data analysis, into ↑-risk, neutral or ↓-risk groups, based on subjects' correct responses to proper food handling procedure scenarios.</p> <p>Client questionnaire used to assess: How home-delivered meals were handled, how meals were held before consumption, length of time between delivery and consumption, and handling of leftovers before consumption, and demographics and general food safety knowledge.</p>	<p>Significant differences among groups on the basis of derived food safety knowledge score were observed in terms of whether or not they ate meal immediately ($P \leq 0.05$).</p> <p>63% reported that they ate their meals as soon as delivered; of those who did not eat meals immediately after delivery, 82% stored cold food in refrigerator and 58% stored hot food in freezer, but 37.7% did not keep hot food safe after meals were delivered and instead left food on counter or table.</p> <p>57.1% who ate meals immediately did not re-heat the foods before eating them, even though those meals were not perceived as hot.</p> <p>35% reported that they had leftovers and only 15% ate leftovers within two hours, 41% reported that they ate leftovers between four hours and four days after delivery.</p>	<p>Data is based on self-report.</p> <p>Per authors:</p> <p>Subjects had to hand back envelopes with completed survey to driver regardless of whether sealed or not.</p> <p>Some subjects may have been uncomfortable with the idea that driver might read negative comments.</p> <p>Reliance on participant's subjective opinion to determine their perception of food temperature.</p>

			Study showed that total time period from preparation at the sites to time of consumption depends primarily on time of consumption after delivery, rather than time required for delivery.	
<p>Byrd-Bredbenner et al, 2007</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>N=154 young adults at a northeastern university in the US.</p>	<p>Home kitchen audits assessed kitchen cleanliness, appliance cleanliness, cleaning supplies availability, temperatures (thermometer access and refrigerator/freezer temperatures), cold food storage, dry food storage and poisons storage.</p>	<p>Participants scored $\geq 70\%$ on poisons storage, dry food storage, kitchen cleanliness and cleaning supplies availability, with females scoring \uparrow than males on kitchen cleanliness ($P=0.0183$) and cleaning supplies availability ($P=0.0305$).</p> <p>Participants scores $<60\%$ on the appliance cleanliness and cold food storage scales.</p> <p>Performance was lowest on temperatures scale; only 7% of kitchens had food thermometer.</p>	<p>Temperature measurements not available for all participants due to thermocouple malfunction.</p> <p>Home kitchen audits limited to participants at one university.</p>
<p>Byrd-Bredbenner et al, 2008</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>N=4,343 college students (65% female, 35% male) from 21 colleges and universities located in 17 US states.</p> <p>Mean age: 19.92 ± 1.67 years.</p> <p>84% prepared one meal per day.</p>	<p>On-line survey assessed:</p> <p>Consumption of risky foods and preparation behaviors (six safe foods, 20 risky foods, seven risky behaviors) (Scale 1-5).</p> <p>Food safety self-efficacy (24 items, 1-5 scale), stage-of-change (1-5 scale), and knowledge (zero-89).</p> <p>Perceived food poisoning a threat (1-5 scale).</p> <p>Demographics.</p> <p>Type food safety information exposure.</p> <p>Number of meals prepared weekly (zero to 10 or >10).</p> <p>Prior food poisoning illness.</p>	<p>Self-reported mean risky eating behaviors score 5.1 ± 3.1 (0-27 scale, more risky behavior yields higher score).</p> <p>53% consumed raw homemade cookie dough.</p> <p>33% consumed fried eggs with runny or soft yolks.</p> <p>29% consumed sushi.</p> <p>29% raw sprouts.</p> <p>11% raw oysters, clams or mussels.</p> <p>7% consumed hamburgers cooked rare.</p> <p>Men ate significantly more risky foods than women ($P<0.0001$), white participants engaged in significantly more risky eating behaviors than</p>	<p>Not randomized /nationally representative sample.</p>

			nonwhite participants (P<0.001).	
<p>Kosa et al, 2007</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>N=2,060 nationally representative sample of adults in the United States (249 pregnant women, 946 older adults and 865 from the remaining population).</p>	<p>Data collected on refrigerator thermometer ownership, home refrigerator temperatures and frequency of cleaning for home refrigerators.</p> <p>Demographic characteristics of consumers following government-recommended refrigerator practices were also assessed, in terms of gender, age, educational background, marital status, household size, race or ethnicity, household income, metropolitan status, and whether or not a member of household had been diagnosed with diabetes, kidney disease or another condition that weakens the immune system.</p>	<p>About half (47.4%) of all respondents had cleaned their refrigerators at least one month prior to the survey.</p> <p>Only 10.7% of all respondents had a thermometer in their refrigerator prior to the survey.</p> <p>After receiving the refrigerator thermometer as part of the survey, 72% of all respondents reported that they refrigerators were at recommended temperature.</p>	<p>Not all respondents completed all questionnaire information.</p> <p>Relatively small sample size of pregnant women.</p> <p>Self-reported practice may not reflect actual practice.</p>
<p>Kwon et al, 2008</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>N=1,598 female participants in the Special Supplemental Nutrition Program for WIC from 87 WIC agencies in 31 states in US</p> <p>Age: 18 to 21 (18.6%), 21 to 25 (28.8%), 26 to 30 (22.8%), 31 to 35 (15.6%) years.</p> <p>47.9% non-Hispanic white, 12.1% non-Hispanic black, 33.2% Hispanic</p> <p>36.8% completed high school (HS), 9.5% completed college degree, 9.1% had ≤8th grade level education.</p>	<p>Design: A survey was conducted with clients from 87 WIC agencies nationwide to assess food safety knowledge and behaviors of WIC Program participants in the US.</p>	<p>Knowledge and behavior scores differed significantly among participants of different education levels and racial or ethnic groups (P<0.001) with those with some HS or less education having significantly ↓ knowledge and behavior scores than respondents with HS or beyond HS.</p> <p>White respondents had significantly ↑ knowledge scores than Hispanic respondents and black respondents had significantly ↓ behavior scores than members of other three racial or ethnic groups (P<0.001).</p> <p>Regarding associations between knowledge and behaviors and demographic characteristics, respondents >25 years old had ↑ mean food safety</p>	<p>Results based on self-reported data.</p>

			<p>knowledge and behavior scores than for those 18-25 years old.</p> <p>Hispanic or black respondents and those who did not graduate from HS were less likely to have used a food thermometer.</p> <p>White respondents with HS education thawed frozen meat, poultry and fish items more safely than Hispanic and black respondents, and those without a high school diploma</p> <p>More black respondents consumed undercooked ground beef patties than did whites or Hispanics.</p> <p>Results reinforced previous research indicating discrepancies between knowledge and reported food handling behaviors existed in cleaning and sanitizing cutting boards, handling hot food leftovers, using food thermometers, and checking doneness of ground beef patties.</p>	
<p>Roseman M, 2007</p> <p>Study Design: Cross-Sectional Study</p> <p>Class: D</p> <p>Rating: </p>	<p>N=220 adults >60 years who participated in either congregate or home-delivered meals program in Kentucky.</p> <p>85% white.</p> <p>52% had not completed high school.</p> <p>69% lived alone.</p> <p>35% response rate.</p>	<p>Survey including 21 questions related to food safety perceptions, food safety behaviors and emergency food preparedness.</p>	<p>27% reported food borne illness was not a common problem; 21% thought the problem more frequently occurred out of the home.</p> <p>21% reported leaving casseroles or similar food on counter for >two hours before throwing it away.</p> <p>50% of subjects >91 years kept all or part of their unconsumed meal on counter; 36% of 60-70 year olds practiced this behavior.</p> <p>10% reported if casserole or similar food were left on counter overnight, they would still eat it.</p>	<p>Conclusions based upon self-reported behaviors.</p>


			16% were somewhat or not likely to wash hands before eating their meal.	
<p>Trepka M, Newman F et al, 2007</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>Initial N=342.</p> <p>Final N=299 female WIC clients from inner-city Miami.</p> <p>64% non-Hispanic, non-Haitian black; 27.1% Hispanic.</p> <p>21.5% pregnant.</p> <p>89.4% graduated from high school.</p> <p>87.4% response rate.</p>	<p>Three-item self-administered questionnaire; captured five constructs of food safety behavior, with the first four from the Partnership for Food Safety Education's Fight BAC! campaign.</p> <p>Dependent Variables</p> <p>Four construct scores: clean, separate, cook, chill.</p> <p>Score concerning avoidance of unsafe foods during pregnancy.</p> <p>Variables measured using 23-item self-administered survey.</p> <p>Independent Variables</p> <p>Nine participant characteristics: Age; education; race/ethnicity; country of birth; employment status; pregnancy status; number of children; diarrhea among household members in last month; household member at risk for food-borne illnesses.</p>	<p>12.6% reported not properly cleaning cutting boards after contact with raw meat.</p> <p>~25% reported using cooking thermometer "almost always" or "always" for cooking whole chicken or turkeys (23.4%) or other large pieces of meat (22.3%).</p> <p>24.4% reported owning a thermometer.</p> <p>24.7% reported usually eating undercooked eggs.</p> <p>32.2% reported usually leaving food out for more than two hours.</p> <p>3% reported refrigerating large amounts of leftovers in shallow containers.</p> <p>10.8% reported leaving formula or bottled breast milk outside refrigerator for >two hours "most of the time," "almost always," or "always."</p> <p>61.8% reported thawing foods on countertop or in sink in standing water.</p> <p>51.6% pregnant women reported eating hot dogs or deli meats without first reheating sometimes or more frequently, since becoming pregnant.</p> <p>35.5% reported eating soft cheeses and blue-veined cheeses sometimes or more frequently, since becoming pregnant.</p>	<p>Conclusions based upon self-reported behaviors.</p>

<p>Yarrow L, Remig V et al, 2009</p> <p>Study Design: Non-randomized trial</p> <p>Class: C</p> <p>Rating: </p>	<p>N= 59 college students (38 females, 21 males).</p> <p>Age: 21 to 49 years.</p> <p>Either health majors (N=38) or non-health majors (N=21):</p> <p>Of 38 health majors: 29 held job as food server, 24 held job as food preparer (cook), and 22 had food safety certification.</p> <p>Of 21 non-health majors: 15 held job as food server, eight held job as food preparer (cook) and six had food safety certification.</p>	<p>Design:</p> <p>College students completed food safety questionnaire (FSQ) prior to educational intervention involving three interactive modules and then after subjects completed modules.</p> <p>FSQ administered after exposure to intervention and five weeks later to determine Δ in food safety attitudes, beliefs, knowledge and self-reported practices.</p> <p>The University survey system, an online platform for conducting surveys, used to administer FSQ.</p> <p>Subjects completed FSQ in this time order: Pre-intervention (prior to viewing educational food safety modules), post-intervention (up to one week after module completion) and post-intervention (five weeks after module completion).</p> <p>Tests assessed food safety knowledge and self-reported food safety behaviors.</p>	<p>Self-reported safe food practices became more frequent over time, with scores \uparrow from 19 to 21 of 27 possible points ($P \leq 0.001$).</p> <p>Students became less likely to prepare food for others if they had diarrhea ($P \leq 0.001$), and more likely to use food thermometers ($P \leq 0.01$).</p> <p>Reported Δ can be attributed to health majors' improvement in not preparing food for others if they had diarrhea ($P \leq 0.002$), thermometer use ($P \leq 0.006$) and not leaving cooked items out for use later in day ($P = 0.046$), such as a buffet or party.</p> <p>Non-health majors did not improve in self-reported practices.</p> <p>As a total group and sub-groups, NS Δ occurred among students' self-reported practices for food sanitation, hygiene, storage, thawing, or \uparrow-risk food intake.</p> <p>Health majors scored \uparrow than non-health majors for all indices in each time period except for \uparrow risk food intake ($P \leq 0.001$).</p> <p>Even after food safety beliefs and knowledge improved with exposure to intervention, non-health majors were not more inclined to Δ their risky behaviors (such as using thermometers and eating fewer risky foods).</p>	<p>Non-representative small sample of college students.</p> <p>Internal validity threats related to testing and mortality (drop-out rate) (sensitization to food safety issues due to repeated testing and non-health majors had higher drop-out rate).</p> <p>Possible external validity threats include interaction of testing and treatment (intervention) (performance from earlier treatment could have affected treatment test performance from later treatment).</p> <p>Reactivity could pose threat because incentive to complete required steps may have differed between health and non-health majors (non-health majors may not have viewed the education as important to their professions).</p> <p>Prior nutrition education courses for health majors could influence scores on all variables.</p>
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Research Design and Implementation Rating Summary

For a summary of the Research Design and Implementation Rating results, [click here](#).

Worksheets

 [Abbot JM, Byrd-Bredbenner C, Schaffner D, Bruhn CM, Blalock L. Comparison of food safety cognitions and self-reported food-handling behaviors with observed food safety behaviors of young adults. *Eur J Clin Nutr*. 2009 Apr; 63 \(4\): 572-579. Epub 2007 Nov 14.](#)


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 [Almanza BA, Namkung Y, Ismail JA, Nelson DC. Clients' safe food-handling knowledge and risk behavior in a home-delivered meal program. *J Am Diet Assoc*. 2007 May; 107\(5\): 816-821.](#)


 [Byrd-Bredbenner C, Maurer J, Wheatley V, Cottone E, Clancy M. Food safety hazards lurk in the kitchens of young adults. *J Food Prot*. 2007 Apr; 70 \(4\): 991-996.](#)


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 [Kwon J, Wilson AN, Bednar C, Kennon L. Food safety knowledge and behaviors of women, infant, and children \(WIC\) program participants in the United States. *J Food Prot*. 2008 Aug; 71: 1,651-1,658.](#)

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 [Roseman, MG. Food safety perceptions and behaviors of participants in congregate-meal and home-delivered-meal programs. *J Environ Health*. 2007; 70 \(2\): 13-21.](#)

 [Trepka MJ, Newman FL, Dixon Z, Huffman FG. Food safety practices among pregnant women and mothers in the women, infants and children program, Miami, Florida. *J Food Prot*. 2007; 70: 1,230-1,237.](#)

 [Yarrow L, Remig VM, Higgins MM. Food safety educational intervention positively influences college students' food safety attitudes, beliefs, knowledge and self-reported practices. *J Environ Health*. 2009; 71 \(6\): 30-35.](#)